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The Distribution and Abundance of Deep Water Fish along the Mid-Atlantic Ridge from 43° N to 61° N.

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ABSTRACT

The data we present were collected from one trawl and three longline exploratory surveys and covering the depths between 400 and 2,000 meters. The majority of the information is from depths between 500 and 1,200 meters.

Information on 56 species from 27 families is presented with regard to temperature, geographical distribution and depth. For some species, new information on geographical distribution is presented.

In the northern part of the ridge (north of 52° N) sub arctic species such as Sebastes spp., tusk (*Brosme brosme)* and Greenland halibut (*Reinhardtius hippoglossoides*) are dominant. In the southern part (south of 48° N), sub tropical species such as golden eye pearch (*Beryx splendens*) and cardinal fish (*Epigonus telescopus*) are the dominant species. In the area between 48° N and 52° N there is a change in species composition. Some species seem to have their northernmost distribution, on the ridge, in this area, and others seems to have their southernmost distribution in this area.

However some species such as orange roughy (*Hoplostethus atlanticus*), round nose grenadier (*Coryphaenoides rupestris*) and leafscale gulper shark (*Centrophorus squamosus*) are distributed in the whole area.

INTRODUCTION

The fish fauna along the Mid-Atlantic Ridge is relatively poorly known regarding both species composition and abundance. Most of the ridge between the Azores and Iceland has until recently been relatively unexploited. This area is thereby one of the few nearly pristine ecosystems shallower than 2.000 meters in the North Atlantic.

Diminishing returns of many exploited fish stocks in the North Atlantic has created an interest in species from deeper waters. The fishery activity is now increasing. Soviet fishermen started a fishery for *Coryphaenoides rupestris* with pelagic trawl in 1973. The fishery peaked with a total catch of 30.000 tons (Troyanovsky and Lisovsky 1995). The Soviet fishery ended in the

beginning of the 1990's, due to the economic difficulties. However in 1994 a Russian fishery for *Beryx splendens* started. In 1994, a Faroese fishery for *Hoplostethus atlanticus* also started. In 1996 Norwegian and Icelandic longliners started a fishery for *Sebastes marinus* (giant type), *Brosme brosme*, *Reinhartius hippoglossus* and *Hippoglossus hippoglossus* in the area between 54 and 61°N.

MATERIAL AND METHODS

The investigations were carried out through four experimental expeditions using hired commercial vessels in the period between 1993 and 1997 (Table 1). The selected areas are listed below and shown in Figure 1.

A) The Reykjanes Ridge, 60-61°N
B) The Reykjanes Ridge, 54-56°N
C) Hecate Seamount, 52°N
D) Faraday Seamounts 59°N
E) North of the Azores, 43-44°N

Area A, B and C were only investigated by longlines. Area D was investigated by bottom trawl. In area E, both longlines and bottom trawl were used.
For these investigations, the bottom trawl used was an Alfredo no 3 with 100 millimeter mesh size and fitted with a rockhopper groundline. Each haul lasted for 10-40 minutes. The time of effective trawling is undeterminable because the trawl was often fastened in the bottom and also sometimes lifted over coral and rocks. So trawling time therefore does not give any good indication of effort. Consequently, only catch per haul is used in our analysis.

The longline investigations were done using both traditional bottom, or seabed, lines and vertical lines. The hook type was Mustad EZ No. 12 in 1996 and No 13 in 1997. For bait, mackerel was used on 75% of the hooks and squid were used on the other 25%.

Hydrographic observations were made by STD-sonde, which continuously records vertical distribution of temperature and salinity. No observations were done in area D. But data from Faroese investigations in February 1996 have been made available. (B. Thompson, pers. comm.).

RESULTS

Hydrography

The hydrographical conditions in the investigated areas are illustrated in Figure 2 and 3.
The temperature conditions in area A and B is quite similar. The temperature in Area C is 1-1.5° lower than in A and B. From area C and southwards the temperature increases rapidly.

Abundance and species composition

Area A

This area was investigated in May 1996, covering the depth range from 500 to 2,000 metres (Table 2). The gear used was seabed longlines. The predominant species at depths between 500 and 1,000 metres were *Sebastes marinus* (giant), *Brosme brosme* and *Centroscyllium fabricii*. The *Sebastes marinus* were located very close to the top of submarine mountains and coral formations. Catch per 1,000 hooks varied between 0 and 500 kg. However, often only a small part of the longline deployments coincided with the schools, and the catches per 1,000 hooks were often between 1,000 and 2,000 kg on this section of the longline.

Brosme brosme showed a more even distribution. Catch per 1,000 hooks varied between 0 and 340 kg. Catches of *Centroscyllium fabricii* fluctuated greatly. On some of the longlines deployed, this species was totally predominant, with the result that virtually no other fish were caught.

Evidently there is a change in species composition at around 900–1200 metres in the temperature range 4–3.6 °C. At depths greater than 1,000 metres the predominant species were *Reinhardtius hippoglossus*, *Macrourus berglax* and *Antimora rostrata*. Catches of *Reinhardtius hippoglossus* varied between 0 and 750 kg per 1,000 hooks, with the largest concentrations being found at depths of approximately 1,600 metres. At this depth the largest catches were made on and in the vicinity of coral reefs. Catches were extremely small in coral-free areas. None of these species was caught at depths of less than 900 metres.

The skates *Raja pallida* and *Bathyraja richardsoni* were recorded at depths of 1,500–2,000 metres. These species have not previously been recorded in this area. Dr Mathias Stehman subsequently examined these specimens and confirmed that the species had been correctly identified.

Only two species, *Etmopterus princeps* and *Anarhichas denticulatus*, were recorded throughout the entire depth range studied.

Area B

This area was investigated in July 1997, using both vertical and conventional seabed longlines (Table 3). The data for both types of gear are combined. Any catch differences between these gears are not taken into consideration. The depth range 400–1,700 metres was studied, but only six deployments – of seabed longlines – were made at depths greater than 1,000 metres.

The main species at depths shallower than 1,100 metres were *Sebastes marinus*, *Brosme brosme* and *Etmopterus princeps*. As in Area A, *Sebastes marinus* was concentrated in schools very close to the top of submarine mountains. The reason why the depth distribution ranges from 400 to 1,000 metres is that fishing took place on four different seamounts with different summit depths.

Brosme brosme was more evenly distributed, as in Area A. Occurrences of *Etmopterus princeps* fluctuated greatly. At night-time in particular this species occupied practically all the hooks, with the result that virtually no other species were caught.

At depths greater than 1,000 metres, catches were dominated by *Antimora rostrata* and *Macrourus berglax*. As in Area A, *Antimora rostrata* was found only at depths exceeding 1,000 metres, while *Etmopterus princeps* was found throughout the depth range.

Area C

Hecate Seamount is immediately north of the Charlie Gibbs Fracture Zone. Investigations were carried out in July 1997, using the same vessel and gear as in Area B. The depth range extended from the top of the bank (600 metres) down to 1,800 metres (Table 3).

The predominant species at depths of less than 1,000 metres were *Brosme brosme*, *Anarhichas denticulatus*, *Etmopterus princeps* and *Macrourus berglax*. As in Areas A and B, *Brosme brosme* was found as deep as 1,100 metres. In contrast to Areas A and B, only insignificant numbers of *Sebastes marinus* were found. Significant schools of *Coryphaenoides rupestris* were observed by eccosounder on this bank. This fish is seldom caught on longlines, so the catch results do not provide a representative picture of stocks. However the fact that we caugth this species in areas where the schools were observed confirm that the registrations actually were *Coryphaenoides ruspestris*. Like *Sebastes marinus* further north, this species forms dense schools close to the top of submarine mountains and therefore probably fulfils the role of "summit living fish" in the same way as *Sebastes marinus*.

At depths greater than 1,000 metres the predominant species were *Hydrolagus affinis*, *Antimora rostrata* and *Macrourus berglax*. In Areas A and B, the first two aforementioned species were caught only at depths exceeding 1,000 metres. In Area C, however, *Antimora rostrata* and *Macrourus berglax* were found as far up as 600–700 metres and *Hydrolagus affinis* as shallow as 700–800 metres. Temperature would appear to be what determines the depth distribution of these species. They do not seem to be present in water warmer than about 4 °C. It was interesting to note that this area contained *Reinhardtius hippoglossus*, which also seemed to be dependent on temperatures below 4 °C. Two such specimens were caught at depths of 800–900 metres. This observation extends the known area of distribution for this species, which had not previously been recorded south of 58° N on the Reykjanes Ridge (Magnússon et al 1997).

Area D

Two submarine mountains close to the Faraday Fracture Zone were investigated by bottom trawl in September 1993. Seven trawls were made at depths between 700 and 1,200 metres. Table 4 however, gives data for 700-900 m. This is because mean depths for each trawl haul is used. Seabed conditions were extremely difficult and it proved impossible to continue investigations in this area.

The species caught at the trawl stations in Area D are listed in Table 4. The main species was *Coryphaenoides rupestris*, which was present in schools around the tops and along the upper slopes, as in Area C.

We also caught *Hoplostethus atlanticus* in this area. We did not find this species in the areas further north, the reason being that it cannot be caught with longlines.

Brosme brosme was not caught in this area, and it would appear that the southern limit for the distribution of this species is somewhere around here. Because this fish is seldom caught by trawling, we are unable to confirm this, however.

Area E

This area was investigated with trawls in 1993 and longlines in 1996, and is therefore the only area to have been studied using both types of gear. Trawling took place in the depth range 500–1,200 metres. Table 4 shows the yield per trawl. Normally the yield per hour of trawling is used as a target for the yield per unit deployed. During seabed trawling in this area it was difficult to estimate the effective trawling time because the gear frequently had to be raised from the bottom to avoid becoming caught. In more than 90% of trawls the gear became caught on the seabed and time had to be spent freeing it. It therefore proved impossible to record the effective trawling time. Likewise it was difficult to determine the precise depth range in which fishing was taking place, particularly in areas with steep seabed inclines.

The two predominant species in this area were *Beryx splendens* and *Epigonus telescopus*. *Beryx splendens* was concentrated in dense schools close to the top of submarine mountains in the temperature range 9.4–11.2 °C. Catch ranged from 0 to 16,000 kg per trawl. *Epigonus telescopus* was usually distributed further down the slopes, but this species also formed dense schools. On one occasion our trawl encountered one of these schools, yielding a catch estimated to 60,000 kg (approx). For the other trawls, catch ranged from 0 to 1,000 kg.

Hoplostethus atlanticus, the largest concentrations of which were recorded at 800–1,200 metres in the temperature range 7–9 °C, was one of the dominant species in this depth range. *Hoplostethus mediterraneus* too was another dominant species in the trawl investigations, but was caught mainly at depths of 500–800 metres.

Longline investigations were carried out in the depth range 400–1,300 metres. The predominant species at depths of 400–900 metres were *Centrophorus squamosus, Mora moro* and *Polyprion americanus* (Table 5). At depths of 900–1,300 metres the two predominant species were *Centroscymnus coelolepis* and *Centroscymnus crepidater*.

Species composition was very different from the 1993 trawl catches. *Epigonus telescopus, Aphanopus carbo, Hoplostethus atlanticus* and *Hoplostethus mediterraneus* were not recorded in the longline catches, whereas *Conger conger* was caught on the longlines but not in the trawls.

On the other hand, *Beryx splendens* was present and was also observed in schools above the submarine mountain tops. The schools were smaller than those seen in 1993.

All areas combined

Species composition varies according to depth, temperature and seabed conditions. In addition, the mix of species caught depends on the type of fishing gear used.

Table 6 shows that species composition varies from area to area. Species such as *Reinhardtius hippoglossoides* and *Macrourus berglax* are found only in the northern areas. *Beryx splendens*

and *Polyprion americanus* are found only in the southern areas. Species such *as Deania calceus* and *Centroscymnus coelolepis* are present throughout all areas.

The effect of the gear on species selection can be clearly seen in the area E. *Hoplostethus atlanticus* and *Coryphaenoides rupestris* were caught with trawls but not with longlines. *Conger conger* was numerous among the longline catches in this area but was not caught by trawling.

Discussion

The ability of different types of fishing gear to catch the various species has a major impact on the results. The weak spot in our investigations is the fact that all areas, with one exception, were studied using only one type of gear. The results from Area E, where both longlines and trawls were used, clearly show the extent of the differences in species selection between the two types of gear.

Nevertheless, it is possible to form an impression of species composition, density and distribution in the areas studied. According to Whitehead (1989) only a few of the recorded species are distributed in the investigated areas on the Mid-Atlantic Ridge.

The submarine ridge extending from Iceland to the Azores traverses a region in which the environment changes considerably as you move from north to south. In the northern part, arctic and subarctic species such as *Macrourus berglax* and *Reinhardtius hippoglossoides* are present. In the south, species that are regarded as tropical or subtropical are found, such as *Epigonus telescopus* and *Beryx splendens*. The species composition changes constantly from north to south, but in the area between 47° N and 52° N the change occurs faster than in other areas along the ridge, probably because this area marks a change in sea temperature. Unfortunately this area, where the greatest changes occur, is where we have the least data.

One feature that appears common to all the areas we have studied along the Mid-Atlantic Ridge is that one dominant species forms dense schools close to the top of submarine mountains. In the north, *Sebastes marinus* (giant) forms such schools. Between around 53° N and 46° N, *Coryphaenoides rupestris* is found near the tops, while south of 46° N (approx.) *Beryx splendens* is the predominant species.

The schooling species inhabiting the areas around the top of the seamounts have proved to be the easiest to catch. As mentioned before. fishing for all three of the aforementioned species has been attempted. Fishing for *Sebastes* in the north lasted only one year before catch levels became too low to sustain a profitable fishery. The same thing happened in the case of *Beryx splendens*. where Russian trawlers experienced problems fishing profitably after two seasons in 1994–96 (Anon 1998). Efforts to catch *Coryphaenoides rupestris* are constantly being stepped up. Increases in the reduction of these resources could also lead to changes in the balance between the various species. It therefore seems unlikely that the same results would be obtained if identical investigations were performed in the same areas for a second time. However, a new study of one of the areas would yield valuable information.

A continuous scattering layer at approximately 400–600 metres was detected by echosounder along the entire length of the ridge. The species forming schools around the seamount tops are probably connected with this layer of water. Russian observations have shown that both

Coryphaenoides rupestris and *Beryx splendens* regularly migrate vertically up to the scattering layer to feed (Vinnichenko pers com). As a result of this behaviour, significant quantities of biological material probably are transported vertically, which will also affect species living further down the water column. This layer of water was not studied, but should be a top priority for the next research cruise to the Mid-Atlantic Ridge. Information on the types of organism living there may provide new insights into ecological systems in the area. Magnusson (1996) has shown that the Irminger Sea contains innumerable organisms within this layer. There are also fish inhabiting the actual ridge and in some areas are dominant species, examples being *Etmopterus princeps* and macrourid fish.

Most of the investigations described in this report took place in the depth range 500–1,200 metres. To obtain a clearer idea of the distribution of the various species, investigations should be carried out at greater depths.

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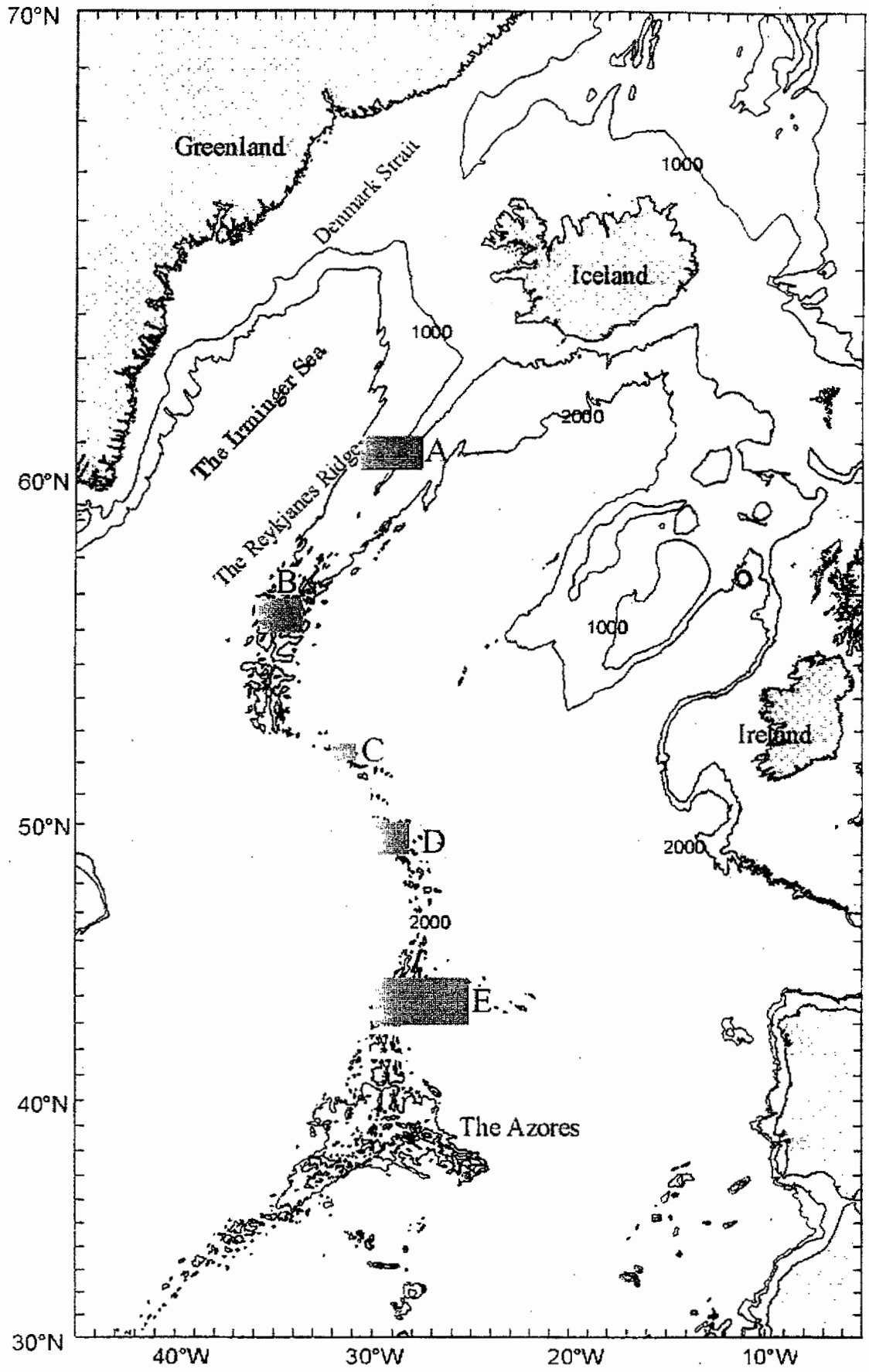

Figure 1. The North Atlantic with investigated areas A, B, C, D and E.

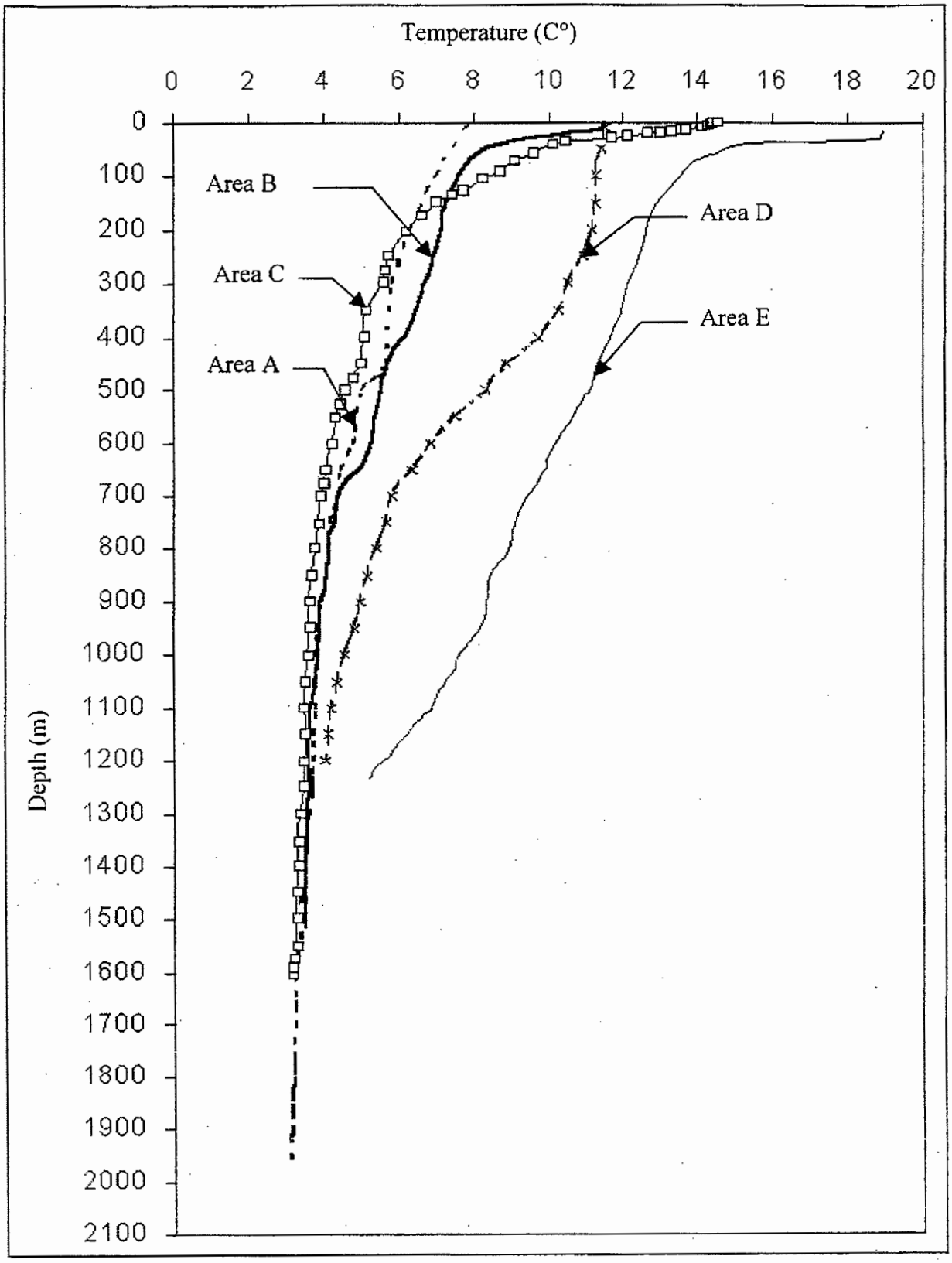

Fig 2. Temperature by depth in the investigated areas A-E

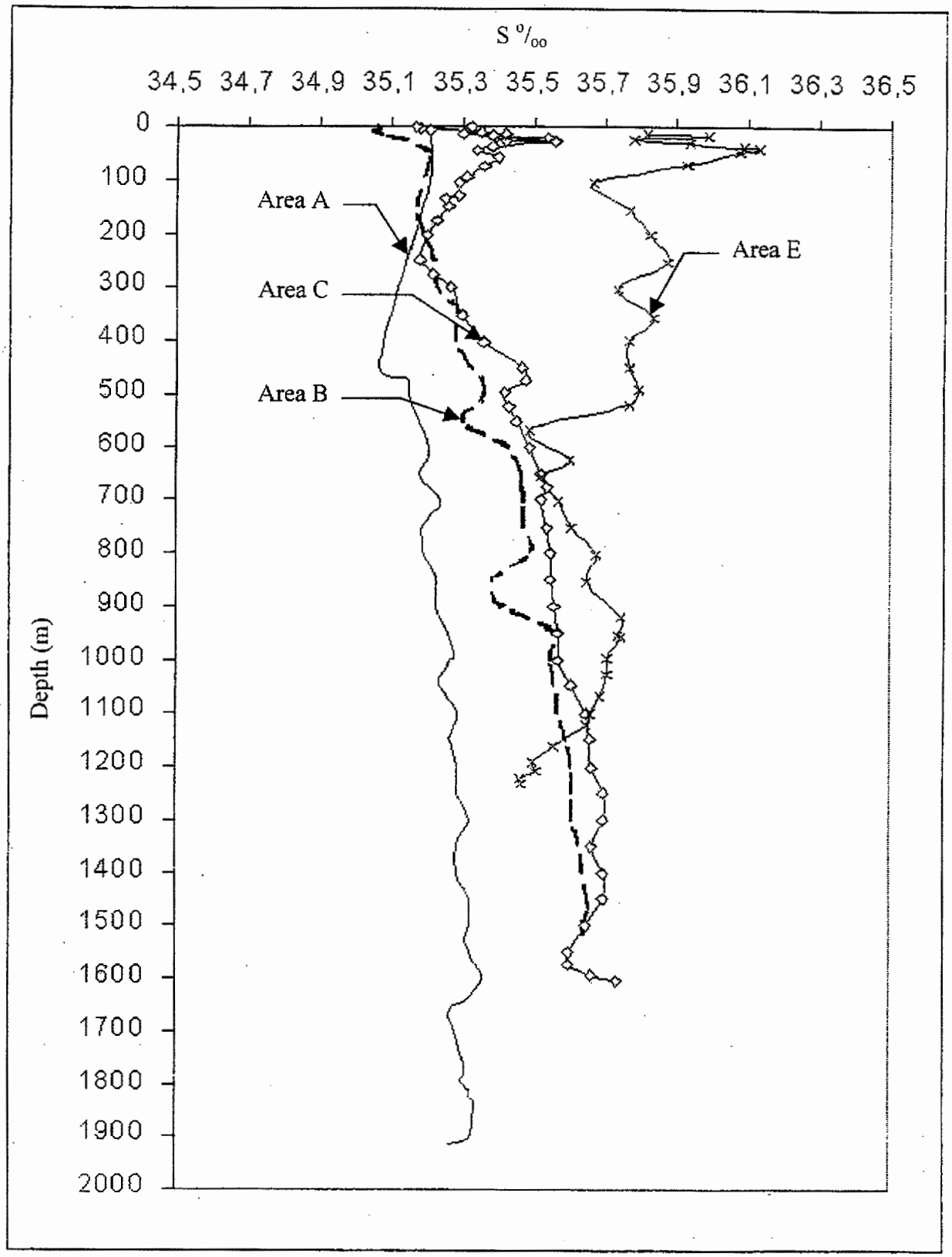

Fig. 3. Salinity by depth in the investigated areas A-E

Table 1. List of Cruises and vessels.

Year	Vessel	Area	Depth (100m)	Days	Gear	Trawl hauls	B. lines	Vert. lines
1993	M/S Ramoen	D	5-12	6	B. trawl	9		
1993	M/S Ramoen	E	5-12	24	B. trawl	119		
1996	M/S Loran	E	5-13	15	L. lines			26
1996	M/S Borgarin	A	5-20	30	L. lines		64	
1997	M/S Skarheim	B	5-17	12	L .lines		3	213
1997	M/S Skarheim	C	5-18	4	L. lines		8	25

Table 2. Catch per 1000 hooks on bottom longline in area A

Depth	500	600	700	800	900	1000	1200	1300	1400	1500	1600	1700	1900
No. Samples	4	11	13	9	4	4	2	2	6	10	10	4	1
Temperature (C°)	4.9°	4.5°	4.2°	4,1°	3,8°	3.8°	3,6°	3.5°	3,4°	3,3°	3,2°	3,2°	3,1°
Alepocephalus bairdii				2.2	0.6	4.0	2.0	1.0	1.0				
Anarhichas denticulatus		8.0	23.0	18.0	21.0	3.0	7.0	1	23.0	11.0	25.2	3.0	
Antimora rostrata						1.6	11.1	36.4	30.3	28.1	30.5	49.2	123.7
Aphanopus carbo				0.1									
Bathyraja richardsoni										3.4			1.2
Brosme brosme	131.0	84.3	163.2	118.5	88.3	72.3							
Centroscyllium fabricii	33.3	48.3	59.2	109.1	116.4	108.0	220.7	46.1					
Centroscymnus coelolepis									8.8	10.5	3.0	4.4	0.6
Deania calcea	4.9	7.2	8.8										
Etmopterus princeps	7.4	10.7	13.2	24.2	25.9	24.0	49.0	10.2	22.0	26.2	7.6	11.1	1.4
Etmopterus spinax											1.5		
Galeus melastomus		47.7	58.5										
Hippoglossus hippoglossus	5.6	8.0	17.5	20.3	29.9	26.6							
Hydrolagus affinis									9.8	14.3	30.8	16.0	12.0
Lepidion eques		0.1	0.6										
Macrourus berglax					0.8	3.1	38.7	52.3	33.6	31.8	32.5	45.3	45.9
Macrourus spp			3.6		3.7								
Molva dypterygia			0.2	1.2									
Raja pallida										2.5		1.0	
Reinhardtius hippoglossoides				1.2			38.3	96.9	65.2	95.2	205.5	106.6	
Sebastes marinus (giant)	163.5	26.5	72.3	43.9	2.8	35.2							
Sebastes mentella	3.3	0.5	1.4	0.9	0.1	0.7		1.1		0.2			
Somniosus microcephalus	48.0		26.2						51.1				
Synaphobranchus kaupii			0.2	0.1			0.1		0.2				

Table 3. Average catch (kg) per 1,000 hooks in Areas B and C.

	Area B										Area C							
Depth (m)	400	500	600	700	800	900	1000	1500	1600	1700	600	700	800	900	1100	1300	1400	1700
No. of sets of gear	7	32	66	62	25	19	2	2	1	1	9	5	5	7	5	1	1	2
Temperature (°C)	6.1°	5.4°	5.2°	4.4°	4.1°	3.8°	3.6°	3.4°			4.0°	3.8°	3.7°	3.6°	3.5°	3.3°	3.2°	3.1°
Alepocephalus bairdii													3.2					
Anarhichas denticulatus	16.4	54.4	44.9	31.5	55.1	63.0	32.8				43.9	78.0	104.8	205.8	339.9		53.3	
Antimora rostrata								58.2	52.9		29.1	18.2	61.6	31.4	129.6	29.9	27.5	28.9
Bathyraja richardsoni															5.8			
Brosme brosme	79.2	263.5	269.2	255.7	274.2	98.7	684.1				375.2	297.0	210.8	123.3	93.8			
Centroscymnus coelolepis		34.4	79.3	64.2	60.6	63.7		14.4										
Centroscymnus crepidater			8.3															
Chaliura spp.															0.2			
Coryphaenoides rupestris			5.6								23.6	12.0	3.9	89.1	3.1	10.5		
Etmopterus princeps		66.4	222.6	382.4	493.3	638.5	747.0	20.2	45.6		124.3	257.6	262.7	104.2	137.5			
Galeus murinus												1.1						
Hydrolagus affinis					41.3							33.3	85.5	60.0	100.2	80.0	132.2	313.2
Lepidion eques		1.4	1.1	2.1		1.9					3.9	2.6	2.8	31.8	1.3			
Lepidon schmithi																	26.1	
Macrourus berglax		5.1	9.8	8.1	21.9	4.1	8.3	28.9			79.6	18.2	44.9	108.7	71.8	82.5	16.5	7.9
Prionace glauca													7.3					
Reinhardtius hippoglossoides													5.9					
Sebastes marinus (giant)	282.3	335.3	437.3	456.8	235.7	80.9	598.3				5.1							
Sebastes mentella		6.9	11.9	10.1	11.1	6.4					6.1							
Sebastes viviparus				4.6														
Somniosus microcephalus						*												
Synaphobranchus kaupii								0.2										

Table 4 Average catch (kg) per trawl haul in Area D and E. (* = weight not calculated)

	Area D			Area E				
Average depth	700	800	900	500	600	700	800	900
Number of hauls	3.0	2.0	2.0	34.0	41.0	12.0	14.0	12.0
Temperature (C °)	5.5-7.0°	5.5-5.0°	5.0-4.7°	11.2-10.2°	10.2-9.4°	9.4-8.9°	8.9-8.2°	8.2-7.6°
Allocyttus verrucosus							6.0	
Aphanopus carbo	50.0				3.6		656.0	29.7
Argentina silus	5.0							
Beryx decadactylus				14.5	30.0			
Beryx splendens				2572.7	3492.9	518.6	380.7	720.1
Centrophorus squamosus					23.7	70.0	37.0	35.0
Centroscymnus coelolepis					20.0	55.5		
Chimaera monstrosa								21.0
Chlamydoselachus anguineus				*	*			
Coelorinchus coelorinchus				*				*
Corypaenoides rupestris	240.0	84.5	312.5	10.5			325.0	7.5
Dalatias licha				33.8	21.0	58.0		
Deania calceus	6.0	10.0	190.0	2.0	18.0	60.0		
Epigonus telescopus				445.5	751.9	727.6	7327.9	733.8
Epigonus denticulatus				*	*			
Etmopterus princeps	120.0	30.0	285.0				10.0	30.0
Helicolenus decadactylus				5.3	4.5			
Hexanchus griseus				133.5	172.5			45.0
Hoplostethus atlanticus	60.0	9.0	50.0	161.0	119.6	45.0	945.8	400.3
Hoplostethus mediterraneus				52.6	162.4	113.2	38.3	32.0
Lophius piscatores	*			*				
Lophius spp.				30.0				
Macrourus berglax	9.0							
Micromesistius poutassou				*	*			
Molva dypterygia	*			7.5				
Mora moro				236.9	228.5	27.5	159.2	139.2
Notacanthus chemnitzii						*		
Phycis blennoides					4.0			
Oxynotus paradoxus					*	*		
Polyprion americanus				30.0	10.1	5.1		
Raja batis			*					
Sebastes mentella	10.0	2.5	10.0	8.1	4.0			

Table 5 Average catch (kg/ 1000 hooks) in area E.

	E							
Depth	400	600	700	800	900	1000	1100	1200
No. samples	1.0	9,0	6,0	3,0	4.0	1.0	1,0	1.0
Temperature	11.5°	9..9°	9.1°	8.4°	8.1°	7.1°	6.1°	5.2°
Aphanopus carbo								
Beryx decadactylus	1.0							
Beryx splendens		1.8	3.6					
Centrophorus lusitanicus								
Centrophorus squamosus	9.9	27.6	71.7	134.5	2.9			
Centroscymnus coelolepis		2.3	1.7		26.2	56.6		
Centroscymnus crepidater			0.1		50.9			
Conger conger		0.2	2.3					
Deania calceus		3.8	7.8	12.6	1.9			
Helicolenus decadactylus	2.9	1.8	4.3					
Hexanchus griseus			1.6					
Lepidion eques	0.5	0.4	0.2			3.5		
Molva dypterygia			1.4					
Mora moro	9.3	18.2	60.4	56.8	1.5			
Pagellus bogaraveo			2.8					
Phycis blennoides		3.7	4.0	2.0				
Polyprion americanus		27.7	19.5					
Pseudotriakis microdon		2.8	7.0					

Table 6. Recorded species in areas A-E.

Family	Species	Area A B. line	Area B Vertic. and B. lines	Area C Vertic. and B. lines	Area D Trawl	Area E Trawl	Area D Vertic. and B. lines
Alepocephalidae	*Alepocephalus bairdii*	*	*	*			
Anarhichadidae	*Anarhichas denticulatus*	*	*	*			
Berycidae	*Beryx splendens*					*	*
	Beryx decadactylus					*	*
Carcharhinidae	*Prionace glauca*			*			
Chlamydoselachidae	*Chlamydoselachus anguineus*					*	
Chimaeridae	*Chimaera monstrosa*					*	
	Hydrolagus affinis	*	*	*			
Congridae	*Conger conger*						*
Dalatiidae	*Dalatias licha*				*	*	
Epigonidae	*Epigonus telescopus*				*	*	
	Epigonus denticulatus					*	
Gadidae	*Molva dypterygia*	*				*	*
	Brosme brosme	*	*	*			
	Phycis blennoides					*	*
	Micromesistius poutasso					*	
Hexanchidae	*Hexanchus griseus*					*	*
Lophiidae	*Lophius spp.*					*	
Macrouridae	*Corypaenoides rupestris*	*	*	*	*	*	
	Coelorinchus coelorinchus					*	
	Macrourus berglax	*	*	*			
	Trachonurus villosus					*	
Moridae	*Antimora rostrata*	*	*	*			
	Mora moro					*	*
	Lepidion eques	*	*	*	*	*	*
	Lepidion schmidti			*			
Notacantidae	*Notacanthus chemnitzii*				*		
Oreosomatidae	*Allocyttus verrucosus*					*	
Oxynotidae	*Oxynotus paradoxus*					*	
Pleuronectidae	*Reinhardtius hippoglossoides*	*		*			
	Hippoglossus hippoglossus	*					
Rajidae	*Raja batis*				*		
	Raja pallida	*					
	Bathyraja richardsoni	*		*			
Scorpaenidae	*Sebastes marinus (giant)*	*	*	*			
	Sebastes mentella	*	*	*			
	Sebastes viviparus		*				
	Helicolenus dactylopterus					*	*
Scyliorhinidae	*Galeus melastomus*	*					
	Galeus murinus	*	*				
	Pseudotriakis microdon						*

Table 6. Continued

Family	Species	Area A B. line	Area B Vertic. and B. lines	Area C Vertic. and B. lines	Area D Trawl	Area E Trawl	Area D Vertic. and B. lines
Serranidae	*Polyprion americanus*					*	*
Sparidae	*Pagellus bogaraveo*						*
Squalidae	*Centrophorus squamosus*	*			*	*	*
	Centroscymnus coelolepis	*	*		*	*	*
	Centroscymnus crepidater	*	*				*
	Deania calceus	*			*	*	*
	Etmopterus princeps	*	*	*	*	*	
	Etmopterus spinax	*	*	*			
	Centroscyllium fabricii	*					
	Centrophorus lusitanicus						
	Somnius microcephalus	*	*				
Synaphobranchidae	*Synaphobranchus kaupii*	*	*	*			
Trachichthyidae	*Hoplostethus atlanticus*				*	*	
	Hoplostethus mediterraneus				*	*	
Trichiuridae	*Aphanopus carbo*	*			*	*	